Minufiya University
Faculty of Engineering
Civil Engineering Dept.
Final Examination,

Highway Bituminous Materials
Code: CVE528
Time Allowed: 3 Hours
Date: 5 /6/2017

Question 1 *(25 marks)*

1- Compare between the following:

- Saybolt furol viscosity and Engler`s viscosity test;
- Liquid asphalts and asphalt emulsions.
- Penetration test and softening point test.
- Seal coat and prime coat.
- Binder course and surface course.
- Bitumen and Tars (discuss different types).

2- Discuss the asphalt modifiers?

3- Talk about the self healing asphalt?

4- Define the rubberized asphalt? Illustrating its benefits? and its uses in practical cases?

Question 2 *(20 marks)*

1- Talk about the physical properties of asphalt?

2- Discuss each Cutback asphalt and air blowing asphalt?

3- What are the objectives and components of Superpave program?

4- Explain the following Superpave tests of asphalt sample clearing the purpose of each test, sample preparation, and test performing:

- Rolling Thin Film Oven (RTFO)
- Dynamic Shear Rheometer (DSR)
- Binding Beam Rheometer (BBR)
- Direct Tension Test (DTT)

Question 3

(15 marks)

1- A hot asphalt concrete mix has a unit weight 2.5 t/m^3 when compacted to 94% of the maximum theoretical density , knowing the following about its constituents . find its percent asphalt content by weight of the total mix?

Material	Specific gravity	% in mix .
Coarse aggregate	2.65	52
Fine aggregate	2.70	40
Mineral aggregate	2.80	8
Asphalt cement	1.02	--

2- The grain size analysis of an aggregate is as the following:

Sieve NO.	4	10	40	60	100	200
% passing	60	56	30	19	13	10

If the previous aggregate used in a surface mixture, determine the approximate value for bitumen content in the mixture?

Question 4 *(25 marks)*

1- Compare between (Hveem Method, Marshall Method and Superpave Method)?
2- Discuss the asphalt behavior as a function of its chemical constituents?
3- Talk about the methods for improving the characteristics of bituminous materials?
4- Define the foamed Asphalt? Illustrating its uses? Advantages? And its effect on asphalt viscosity?
5-Define and illustrate the factors that affect on:
   5- Stability
   6- Durability
   7- Flexibility
   8- Skid resistance

Question 5 *(15 marks)*

A specimen of asphalt it's weight in air and water were 1195 and 685 gm respectively . The proportion of the Mix as follow:

material	Specific gravity	% by weight
Asphalt cement	1.02	5
Lime stone aggregate	2.8	16
Sand	2.86	74
filler	2.9	5

Calculate :

1. The bulk density of the specimen
2. The percent of air voids in the specimen
3. The percent of voids in compacted mineral aggregate
4. The percent of voids in the aggregate that filled with asphalt
5. The theoretical specific gravity of the Mix.
6. Find the relative density of a compacted pavement constructed from the above mix if the core taken from the pavement weight 3600 gm in air and 1950 gm in water .

With my best wishes
Dr. Ahmed Abu El-Maaty

This exam measures the following ILOs (Intended Learning Outcomes)

Question No.	ILOs
1	A-1, A-2, B-3, C-2 , D-7
2	A-3, B-4, B-5, C-1, C-2, D-3, D-6
3	B-4, B-5, A-4, D-4, C-1
4	A-2, C-3, B-4, D-5, C-2
5	A-1, B-3, B-4, C-2, D-3, D-7